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MINN

Semi-Annual Progress Report

NGR-24-005-070

Theoretical and Experimental Investigations of
the Mechanical Strength of Solids

Since the inception of this program six months ago, excellent progress has been made in the following areas:

1. Time dependent macroscopic and microscopic viscoelastic behavior of polymers has been formulated and studied. It is hoped that this work can be fully developed to gain fundamental understanding of the time dependent nature of fracture of solids.

2. Time dependent macro- and micro-strength properties have been worked out on the basis of the statistical theory of absolute reaction rate. Interesting and useful general results were obtained. Detailed discussions were also carried out at a recent International Conference on Fracture, Sendai, Japan, with two Russian scientists who have been working on the time dependent strength of solids for many years. It appears that our findings can be used to explain not only the linear behaviors between the applied constant stress and the logarithm of time to fracture, but also the nonlinear nature of the mechanism under small loads. It is expected that extension of this work would yield farreaching important fatigue and failure information.

3. Internal fracture of a solid under hydrostatic tension was obtained experimentally by converging and reflecting short but intense pulses. An analysis of this pulse wave propagation problem was also carried out. Excellent results are expected from this work.

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